

Claim Objections

On Page 2, Items 2-6 of the Office Action, Claims 6, 7, 13, 14, 25, 27, 29, 31, 57, 59, 61, 63, 70-74, and 87 were found objectionable due to various informalities. By the present Amendment, it is submitted that the Claims have been amended as
5 necessary to overcome such informalities. Claims 13, 45, 73, and 87 were found objectionable by dependency from a rejected base claim, but were noted as allowable if rewritten in independent form to include the limitations of the base Claim and any intervening Claims. Pending reconsideration of Claims 13, 45, and 87 as amended in
10 this application, it is not desired to rewrite such claims into independent form at this time. However, the limitations of Claim 73 have been included in Claim 64 as amended to obtain allowance of such Claims. Withdrawal of the Claim objections is requested.

Rejection of Claims 1-11, 16, 19, 24-43, 48, 51, 56-72, 74-76, 80, 85, and 92 under 35 U.S.C. §102(b) based on U.S. Patent No. 5,679,899 ("the Webster patent")

15 On Page 3, Item 8 of the Office Action, Claims 1-11, 16, 19, 24-43, 48, 51, 56-72, 74-76, 80, 85, and 92 were rejected under 35 U.S.C. §102(b) based on Webster (U.S. Patent No. 5,679,899)("the Webster patent"). The Webster patent and the reasons that Claims 1-10, 24-43, 48, 51, 56-72, 74-76, 80, 85, and 92 were rejected under 35 U.S.C. §102(b) are addressed separately below. Claims 11, 16, and 19 have
20 been canceled without prejudice so that the rejection of these claims is moot.

1. U.S. Patent No. 5,679,899 ("the Webster patent")

U.S. Patent No. 5,679,899 ("the Webster patent") discloses a system detecting structural faults in an object or structure 10 which may be a section of materials including metallic honeycomb, composite materials, or monocoque, semi-monocoque,
25 or other structures (col.4, lines 58-65). The Webster patent nowhere suggests that the object or structure could be a structure such as a house or building. The overall system consists of a system 12 that vibrationally excites the structure point-by-point with acoustic pulses, and a laser Doppler system 14 that scans the surface of the object 10, in synchronism with the point-by-point scanning of the acoustic pulses, then
30 measures the out-of-plane surface displacement of successive points and provides a visual display of the location and extent of structural faults (col. 4, line 65 – col. 5,

line 6). The Webster patent notes that while the illustration shows the systems 12, 14 relatively far apart, they are actually closely spaced so that the acoustic pulses generated by the array of discharge devices 18, 20, 22 and the vibration-sensing laser beam travel substantially unidirectionally (col. 5, lines 7-13). The nature of the discharge devices 18, 20, 22 is not disclosed in the Webster patent, but they are indicated to be capable of generating pulses of one microsecond at a rate of one hundred pulses per second (col. 5, lines 36-44). The effect of the acoustic pulses on the structure 10 is described in the Webster patent to be similar to "tapping" with an implement such as a rod or pencil against the object (col. 5, lines 56-62). An X-Y scan control system 32 scans the focal point of the array of discharge devices 18, 20, 22 (col. 5, lines 44-49). Relaxation frequencies resulting from the structure's response to the acoustic "tapping" are detected by the laser Doppler camera system 72 (col. 5, lines 56-62). A programmed controller 28 coordinates the scanning of the X-Y scan control 32 used to orient the array of acoustic devices 18, 20, 22 to cause the acoustic pulses to strike the surface of the object 10 at spaced sampling points 10a, 10b (col. 5, lines 26-62). The relaxation frequencies caused by the acoustic pulses are detected by a laser Doppler camera system 72 (col. 6, lines 32-38). The programmed controller 28 also controls scanning controller 70 to orient the laser Doppler camera system 72 to direct and receive laser light from the sampling points 10a, 10b struck by the acoustic pulses (col. 6, lines 23-38). The laser Doppler camera system 72 generates a color or monotone printout that indicates by different colors the velocity of movement of the acoustically excited area of the structure 10 (col. 6, lines 39-54). The programmed controller 28 receives the output data of the laser Doppler system 72 and supplies such output data to the analyzer 78 (col. 7, lines 19-31). The analyzer 78 compares acquired data with data in storage device 80 for a fault-free structure constructed of the same material to determine whether a fault is present in the structure (col. 7, lines 19-24). The programmed controller 28 stores in its memory data relating to both the amplitude of surface displacement and details of the relaxation frequencies exhibited by the interrogated area of the object, including spatial information that defines its locations, so that an area exhibiting any fault conditions can later be interrogated (col. 7, lines 32-38). Re-interrogation of an area

exhibiting fault conditions "...can be achieved either by relocation and individual re-examination of the selected area, or by processing the information with data stored in the memory of the computer during the initial scan." (col. 7, lines 32-41).

5 **2. Claims 1-10, 24-43, 48, 51, 56-72, 74-76, 80, 85, and 92 are Patentable over the Prior Art**

 Claim 1 as amended recites a method comprising the steps of: (a) vibrating ground in proximity to a structure resting on the ground to produce vibration in the structure, the structure being a house or building; (b) optically sensing vibration from the structure without contacting the structure; and (c) determining whether a fault
10 exists in the structure, based on the optically-sensed vibration. The Webster patent fails to disclose any step of vibrating ground in proximity to a structure to cause the structure to vibrate. In fact, the Webster patent expressly states that sonic (or air) wave excitation is used to vibrate an object or structure (col. 3, line 66-col.4, line 2), which expressly excludes use of seismic (or ground) vibration as claimed in Claim 1
15 as amended. Accordingly, it is submitted that Claim 1 as amended is patentable over the prior art for this reason.

 Furthermore, the Webster patent discloses that the structure or object
20 can be a section of any materials including metallic honeycomb, composite materials, monocoque, semi-monocoque, or other structures (col.4, l. 58-65). However, the Webster patent nowhere suggests that its object or structure could be a building or house. Accordingly, it is submitted that Claim 1 as amended is patentable over the prior art for this additional reason.

 Claims 2-10 and 24-31 depend, directly or indirectly, from Claim 1 as amended and include all of the limitations of that Claim. Thus, for at least the reasons
25 stated above with respect to Claim 1 as amended, it is submitted that Claims 2-10 and 24-31 are patentable over the prior art.

 Claim 32 recites a method comprising (a) optically sensing vibrations at spaced portions of a structure to produce a first set of vibration data readings; (b) establishing base line data from the first set of vibration data readings for respective
30 spaced portions of the structure; (c) at a time after completion of performance of the sensing of the step (a), optically sensing vibrations at the spaced portions of the

structure to produce a second set of vibration data readings; (d) comparing the vibration data readings of the second set with corresponding vibration data readings of the first set constituting the base line data to generate comparison result data; and (e) determining whether a fault exists in the structure at the time of performance of step (c), based on the comparison result data of the step (d). This method is not disclosed in the Webster patent. More specifically, in many building or house structures, it cannot be known whether fault conditions exist in the structure without first preparing baseline vibration data readings that establish the vibrational characteristics of the structure at some point in time. Then, at a later time, an additional set of vibration data readings can be sensed and compared with the base line data to generate comparison result data, as recited in steps (c) and (d) of Claim 1 as amended. Existence of a fault can then be determined by comparing the additional set of vibration data readings with the base line data in the method of Claim 1 as amended to determine if vibration data of the first set has deviated sufficiently from corresponding baseline data that a fault can be determined to exist in the structure. The Webster patent discloses that relaxation frequencies for each point of a scan can be compared with those of others to determine damaged or fault areas (col. 3, lines 55-61), that relaxation frequencies can be compared with previously measured fault-free surfaces (col. 7, lines 19-27), and that recognized faults can later be re-examined by relocation and re-examination or "...by processing the information with data stored in the memory of the computer during the initial scan" (col. 7, lines 38-41). The meaning of this last statement is unclear, but it is clear that this phrase is given in the context of re-examining a known fault condition, not one that is unknown. In many structures such as buildings or houses, a base line of vibration data for comparison with later acquired data is necessary to determine whether a fault exists therein, because in virtually all instances it is not known in advance of constructing a house or building what its vibration characteristics will be. Hence, the base line can be taken soon after its construction when it is assumed that no fault condition exists in the structure. As the characteristics of the structure change over time, the corresponding vibration readings can be compared with the base line data to determine whether a fault has

developed in the structure. The method of Claim 32 is thus not disclosed in the prior art. Accordingly, it is submitted that Claim 32 is patentable over the prior art.

Claims 33-43, 48, 51, and 56-63 depend, directly or indirectly, from Claim 32 as amended and include all of the limitations of that Claim plus additional limitations that are not disclosed by the prior art. For example, Claim 54 recites that the structure is a building, and Claim 55 recites that the structure is a house. The Webster patent fails to disclose any method like that of Claim 32, let alone one applied to a structure such as a building or house. Accordingly, for this reason as well as those stated above with respect to Claim 32, it is submitted that Claims 33-43, 48, 51, and 56-63 are patentable over the prior art.

Claim 64 includes the limitations of Claim 73 rewritten into independent form to include the limitations of the base claim and any intervening claims. Because Claim 73 was noted as allowable in the Office Action if rewritten into independent form to include the base claim and any intervening claims, it is submitted that Claim 64 is now in condition for allowance. Withdrawal of the rejection of Claim 64 as amended is requested.

Claims 65, 67-72, 74-76, 80, 85, and 92 depend, directly or indirectly, from Claim 64 as amended and include all of the limitations of that claim. Thus, for at least the reasons stated with respect to Claim 64, it is submitted that Claims 65, 67-72, 74-76, 80, 85, and 92 are patentable over the prior art.

Accordingly, for at least the above reasons, it is submitted that Claims 1-10, 24-43, 48, 51, 56-72, 74-76, 80, 85, and 92 are patentable over the prior art. Withdrawal of the rejection of these Claims is requested.

Rejection of Claims 12, 14, 20, 21, 44, 46, 52, 53, 86, 88, and 93 under 35 U.S.C. 103(a) based on the Webster Patent in view of U.S. Patent No. 4,128,011 ("the Savage patent")

On Pages 16-18, Items 10-15, Claims 12, 14, 20, 21, 44, 46, 52, 53, 86, 88, and 93 were rejected under 35 U.S.C. §103(a) as being unpatentable over the Webster patent in view of U.S. Patent No. 4,128,011 ("the Savage patent"). The Savage patent and the reasons that Claims 12, 14, 20, 21, 44, 46, 52, 53, 86, 88, and 93 are patentable over the prior art, are addressed separately below. Claims 12, 20, and 21 have been canceled without prejudice so that the rejection of these Claims is moot.

1. The Savage Patent

U.S. Patent No. 4,128,011 ("the Savage patent") discloses numerous embodiments of methods that vibrate a "structure" over a variable range of frequencies, detecting the frequency response from the "structure," and recording the frequency response (col. 5, lines 41-55). In Fig. 1, a coarse method of detecting subterranean cavities or voids uses a vibration apparatus 1 to produce compression waves over a range of frequencies. Spaced sensors 13 placed on the ground receive vibrations from the underground cavities. Further definition of the cavity size and volume is conducted by triaxial accelerometers inserted in boreholes near the void (col. 7, lines 8-22). Fig. 3A shows a second embodiment in which a sensor capsule 17 is inserted in boreholes 16 for use in detecting a void 18 using vibrations generated by vibration unit 1 against a tunnel face 14 (col. 6, line 62 - col. 7, line 22). Fig. 4 is a third embodiment that is a down hole vibrator 19 with a shell 20 enclosing a gel-like silicon material 24 with suspended magnetic particles 24, 25 that receives a variable frequency electric current from an armored electrical cable, causing the gel to emit vibration into soil or rock medium 30. A down hole sensor capsule 32 receives vibration from the vibrator 30 via soil and rock medium 30 to detect suspected anomalies in such medium (col. 9, lines 31-45). The Savage patent also discusses using the above methods to detect voids under the basement floor of a building (col. 9, line 47-col. 10, line 3). This section of the Savage patent does not discuss searching for faults in the floor, but for voids or cavities in the earth underneath the floor. Section 4 of the Savage patent addresses vibration analysis of beams on an aerospace, off-shore structure, or school building. Multiple wires 45 are set between end points of beams 42 and are set in transverse vibration by electromagnets 46 positioned at the antinodes of the wire 45. The wires 45 are attached to support beams of the structure at different points thereof and are used to vibrate the structure. Accelerometer transducers placed at different positions on the structure to sense the vibrations as the vibration frequencies of the wires are varied (col. 11, lines 29-46; Fig. 7, col. 11, line 62 - col. 12, line 6). A wire 45 can be set into longitudinal modes of vibration by impacting an end of the wire with impact device 48, which may be a solenoid (Fig. 14; col. 13, line 66- col. 14, line 5). Longitudinal waves can also be produced with shock

waves produced in a water-filled tube 50 via a square-wave vibrator 49 (Fig. 15; col. 14, lines 15-28).

2. Claims 14, 44, 46, 52, 53, 86, 88, and 93 are Patentable over the Prior Art

5 The Webster and Savage patents contain no disclosure that would have led a person of ordinary skill in the art to combine their teachings in an effort to obtain the claimed invention. The Webster patent, like the claimed invention, discloses use of non-contact optical sensing to detect vibration in a structure. However, the Savage patent uses non-optical contact sensors to detect support beam vibration in all
10 embodiments concerning off-shore, aerospace, and school building structures. Accordingly, the Savage patent “teaches away” from the Webster patent as well as the claimed invention. The combination of the Webster and Savage patents is respectfully traversed because one of ordinary skill in the art would not have been motivated to combine these two patents as done in the Office Action. Please see, for example,
15 *Okajima v. Bourdeau*, 261 F.3d 1350, 59 U.S.P.Q.2d 1795 (Fed. Cir. 2001), *rehearing denied*, 19 Fed. Appx. 881 (2001), *cert. denied*, 151 L.Ed.2d 969, 122 S.Ct. 1066 (2002)(Board reversal of obviousness rejection sustained for lack of motivation to combine references.).

 In addition, the Webster patent teaches that its acoustic pulse generator 12 and
20 laser Doppler system 14 should be closely spaced together (col. 5, line 7-14). If the acoustic pulse generator 12 were implemented as a vibration apparatus 1 such as that of Fig. 1 of the Savage patent (and there is no suggestion in either the Webster or Savage patent that this be done), the laser Doppler system 12 would certainly be damaged by the movement of the vibration apparatus. One of ordinary skill in the art
25 would thus not have been motivated to combine the Webster and Savage patents because the modification would render the resulting combination inoperative for its intended purpose. Accordingly, the combination of the Webster and Savage patents is traversed for this additional reason.

 Even if the Webster and Savage patents were to be combined as done in the
30 Office Action, the resulting combination fails to disclose the invention as now claimed. Neither the Webster nor Savage patents discloses that a ground vibrator can

be used to cause ground vibrations that induce vibration in a structure such as a house or building, which can be optically sensed to determine whether a fault exists in the structure, as now claimed in Claim 14 as amended. Accordingly, Claim 14 would not have been obvious to a person of ordinary skill in the art. Thus, it is submitted that
5 Claim 14 as amended is patentable over the prior art for this additional reason, as well as those stated above with respect to Claim 1 as amended, from which it depends.

Claims 44 and 46 depend from Claims 32 and include all of the limitations of that Claim. Accordingly, these Claims patentably distinguish over the prior art for the reasons stated above with respect to Claim 32 since the Savage patent fails to disclose
10 the deficiencies of the Webster patent as noted above with respect to Claim 32. In addition, Claim 44 recites that vibration of the ground is used to produce vibrations optically sensed in either or both of steps (a) and (c). Neither the Webster nor Savage patents discloses vibrating the ground to cause ground vibrations that induce vibration in a structure such as a house or building, which can be optically sensed to determine
15 whether a fault exists in the structure, as recited in Claims 44 and 46. Accordingly, Claims 44 and 46 would not have been obvious to a person of ordinary skill in the art considering the Webster and Savage patents. Accordingly, it is submitted that Claims 44 and 46 are patentable over the prior art for these reasons as well as those previously described with respect to Claim 32.

20 Claim 52 depends indirectly from Claim 32 and recites that vibrations are induced in the structure by bumping the structure with a vehicle. Neither of the Webster or Savage patents discloses this feature claimed in Claim 52. Although the Office Action speculates that one might have been motivated to bump a structure with a vehicle because that would impart more energy to vibrating the structure, the
25 motivation to do so could only be gleaned from Applicant's disclosure since it is not disclosed in the Webster and Savage patents. An obviousness rejection cannot be based upon in effect using the teachings of the Applicant against the Applicant. *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988). Accordingly, it is submitted that Claim 52 is patentable over the prior art for this reason in addition to
30 those previously stated with respect to Claim 32.

Claim 53 depends indirectly from Claim 32 and recites that the vibration of the structure can be performed by wind loading. Neither the Webster nor Savage patents suggest using wind loading to induce vibration in a structure that is optically sensed to determine whether faults are present therein. Although the Savage patent discusses the effects of storms such as wave dynamics, wind and gust loads, shear currents, hydrostatic pressures, operating impact and vibration loads, it fails to disclose using any of these as the source for vibration in the structure optically sensed to determine whether a fault exists therein. Accordingly, Claim 53 is patentable over the prior art for this reason as well as for those stated above with respect to Claim 32 because such features would not have been obvious to a person of ordinary skill in the art. Accordingly, it is submitted that Claim 53 is patentable over the prior art.

Claims 86, 88, and 93 depend from Claim 64, which has been amended into independent form to include the limitations of Claim 73, which was allowed in the Office Action. Accordingly, it is submitted that Claims 86, 88, and 93 are patentable by dependency from an allowed Claim. In addition, Claims 86, 88, and 93 parallel Claims 44, 46, and 52 and accordingly would not have been obvious to a person of ordinary skill in the art considering the Webster and Savage patents for similar reasons to those stated above with respect to Claims 44, 46, and 52. Accordingly, it is submitted that Claims 86, 88, and 93 would not have been obvious to a person of ordinary skill in the art, and thus are patentable over the prior art.

Claims 54 and 55 depend from Claim 32, and recite that the structure is a building and house, respectively. The Webster patent fails to disclose any structure that is a building or house, and the Savage patent discloses use of its non-optical contact vibration and sensing techniques on a building, but not on a house. Therefore, because the prior art fails to disclose a method comparable to Claim 32 that is applied to detecting faults in a structure that is a building or house, it is submitted that Claims 54 and 55 would not have been obvious to a person of ordinary skill in the art, and thus are patentable. Furthermore, neither the Webster nor Savage patents recite that their techniques are applied to a house, so claim 55 would not have been obvious to a person of ordinary skill in the art for this additional reason. Accordingly, it is submitted that Claim 55 is patentable over the prior art for this additional reason.

Thus, it is submitted that claims 14, 22, 23, 44, 46, 52-54, 86, 88, and 93 would not have been obvious to a person of ordinary skill in the art under 35 U.S.C. §103(a). Accordingly, it is submitted that all such Claims are patentable over the prior art. Withdrawal of the rejection is requested.

5 **Rejection of Claims 17, 49, and 89 over the Webster and Savage patents, in further view of U.S. Patent No. 6,186,004 B1 ("the Kaduchak patent")**

On Page 18, Item 16 of the Office Action, Claims 17, 49, and 89 were rejected based on the Webster and Savage patents, in further view of the U.S. Patent No. 6,186,004 B1 ("the Kaduchak patent").

10 Claim 17 has been canceled without prejudice so that the rejection of this Claim is moot.

There is no teaching or suggestion in the Kaduchak patent that would have led one of ordinary skill in the art to combine it with the Webster and Savage patents. The Kaduchak patent is directed to non-contact optical vibration and sensing of
15 containers, ordnance, reactor vessels and pipes, tanks, and airplane wings, unlike the Webster patent which is directed to contact vibration and sensing of off-shore, aerospace, and school buildings. Hence, one of ordinary skill in the art would not have been motivated to combine these patents as done in the Office Action, and the rejection is respectfully traversed for this reason.

20 Claims 49 and 89 depend from respective Claims 32 and 64 and include all limitations of those Claims. Because the Kaduchak patent fails to disclose the deficiencies of the Webster and Savage patents as noted above with respect to Claims 32 and 64, respective Claims 49 and 89 patentably distinguish over the prior art.

In addition, Claims 49 and 89 recite that the sonic waves used to vibrate a
25 structure are generated by a speaker. In the Kaduchak patent, very little is stated as to the nature of its transducers 12, other than that they are arranged in a parametric array, and are air-coupled, commercially available, and capable of ultrasonic operation (col. 7, lines 23-50). In the Kaduchak patent, this parametric array of transducers is intended for use in inspection of waste and biological material storage containers and
30 container wall integrity, determination of the contents of ordnance, reactor vessels and pipes, liquid-fill level in tanks, and inspection of airplane wings. The Kaduchak

patent appears to distinguish speakers and ultrasonic transducers as two different classes of devices in the context of its disclosure (col. 5, lines 7-11). Thus, the Kaduchak patent appears to "teach away" from the claimed invention. Accordingly, for these reasons as well as those stated above with respect to Claims 32 and 64,
5 Claims 49 and 89 patentably distinguish over the prior art.

Moreover, Claim 89 depends from Claim 64 that has been rewritten to include all limitations of allowed Claim 73. Thus, Claim 89 is in condition of allowance by dependency from a Claim that has been allowed.

Accordingly, the combination of the Webster, Savage, and Kaduchak patents
10 is respectfully traversed. Furthermore, it is submitted that Claims 49 and 89 are patentable over the prior art. Withdrawal of the rejection is requested.

Rejection of Claims 15, 47, and 90 under 35 U.S.C. §103(a) over the Webster and Savage patents, in further view of U.S. Patent No. 5,798,981 ("the Littlejohn patent")

15 On Page 19, Item 18 of the Office Action, Claims 15, 47, and 90 were rejected based on the Webster and Savage patents, in further view of the U.S. Patent No. 5,798,981 ("the Littlejohn patent").

The Littlejohn patent uses a contact accelerometer 10 to measure frequency response spectra on a rock bolt anchorage 13 for a tunnel or mine. The Littlejohn
20 patent is thus not applied to detection of faults in a structure such as a building or house. Accordingly, one of ordinary skill in the art would not have been motivated to combine the Webster, Savage and Littlejohn patents as done in the Office Action. Thus, the combination of Webster, Savage and Littlejohn is respectfully traversed.

Claims 15, 47, and 90 depend from respective Claims 1, 32 and 64 and include
25 all of the limitations of those Claims. Because the Littlejohn patent fails to disclose the deficiencies of the combination of the Webster and Savage patents as noted above with respect to Claims 1, 32, and 64, it is submitted that Claims 15, 47, and 90 are patentable over the prior art.

Furthermore, the Littlejohn patent, like Webster and the Savage patents, fails
30 to disclose use of an explosion to induce vibration in a structure optically sensed to determine whether a fault is present therein. Accordingly, it is submitted that Claims 15, 47, and 90 are patentable over the prior art for this additional reason.

In addition, Claim 90 depends from Claim 64 that has been rewritten to include the limitations of allowed Claim 73. Accordingly, Claim 90 is allowable by dependency from an allowed Claim.

Accordingly, the combination of the Webster, Savage, and Littlejohn patents is respectfully traversed. Furthermore, it is submitted that Claims 15, 47, and 90 would not have been obvious to a person of ordinary skill over the combination of the Webster, Savage, and Littlejohn patents even if combined. Accordingly, it is submitted that Claims 15, 47, and 90 are patentable over the prior art. Withdrawal of the rejection is requested.

10 Rejection of Claims 18, 50, and 91 under 35 U.S.C. §103(a) as being unpatentable over the Webster and Savage patents, in further view of Becker, TJ "Picking Up Good Vibrations" Georgia Technical Institute Research Horizons May 2000 ("the Becker article")

On Page 19, Item 20 of the Office Action, Claims 18, 50, and 91 were rejected under 35 U.S.C. §103(a) based on the Webster and Savage patents, in further view of the article Becker, TJ; "Picking Up Good Vibrations"; Georgia Technical Institute Research Horizons; May 2000 ("the Becker article").

Claim 18 has been canceled without prejudice so that the rejection of this Claim is moot.

20 The Becker article addresses use of a helicopter and laser vibrometer to inspect wooden power pole cross-arms to ensure that they are structurally sound. However, because the Savage patent is directed to contact vibration and sensing of structures, it is submitted that a person of ordinary skill would not have been motivated to combine the Webster and Savage patents with the Becker article as done in the Office Action. Accordingly, the combination of the Webster and Savage patents and the Becker article, is respectfully traversed. Withdrawal of the rejection is requested.

Claims 50 and 91 depend from respective Claims 32 and 64 as amended and include all of the limitations of those Claims. Because the Becker article fails to disclose the deficiencies of the Webster and Savage patents as stated above with respect to Claims 32 and 64, it is submitted that Claims 50 and 91 are patentable over the prior art.

In addition, Claim 91 depends from Claim 64 that has been rewritten to include the limitations of Claim 64 noted as allowed in the Office Action. It is submitted that Claim 91 is therefore in condition for allowance.

Accordingly, the combination of the Webster and Savage patents with the
5 Becker article is respectfully traversed. In addition, Claims 50 and 91 would not have been obvious to a person of ordinary skill in the art. Accordingly, it is submitted that Claims 50 and 91 are patentable over the prior art. Withdrawal of the rejection is requested.

**Rejection of Claims 77-79 and 81 under 35 U.S.C. §103(a) based on the Webster
10 and Savage patents, in further view of Naiman J "Laser Vibrometers Simplifying
Bridge Condition Evaluation" OE Reports Volume 173 May 1988 ("the Naiman
article")**

On Page 20, Item 22 of the Office Action, Claims 77-79 and 81 were rejected
under 35 U.S.C. §103(a) as being unpatentable over the Webster and Savage patents
15 in further view of the Naiman J "Laser Vibrometers Simplifying Bridge Condition
Evaluation" OE Reports Volume 173 May 1988 ("the Naiman article").

The Naiman article discloses a laser vibrometer used to measure bridge cable
tension. The Naiman article does not disclose active vibration of the bridge, and thus
"teaches away" from the Webster and Savage patents. Accordingly, the combination
20 of the Webster and Savage patents and the Naiman article is respectfully traversed.

In addition, Claims 77-79 and 81 depend from Claim 64 and include all
limitations of that Claim. The Naiman article fails to disclose the deficiencies of the
Webster and Savage patents as previously noted with respect to Claim 64.
Accordingly, Claims 77-79 and 81 would not have been obvious to a person of
25 ordinary skill in the art for this reason.

Also, Claim 64 that has been amended to include the limitations of Claim 73
noted as allowed in the Office Action. Accordingly, Claims 77-79 and 81 are
patentable by dependency from an allowed Claim.

Furthermore, although the Naiman article shows a tripod, it cannot be
30 determined if it discloses a pan/tilt head as recited in Claim 78 or a position controller
as recited in Claim 79. Hence, Claims 78 and 79 may patentably distinguish over the
prior art for this additional reason.

Thus, the combination of the Webster and Savage patents and the Naiman article is respectfully traversed. Furthermore, it is submitted that Claims 77-79 and 81 would not have been obvious to a person of ordinary skill in the art, and thus are patentable over the prior art. Withdrawal of the rejection is requested.

5 **Rejection of Claims 82-84 under 35 U.S.C. §103(a) based on the Webster and Savage patents, in further view of Polytec Product Catalog July 1996 Pages 1-15 (“the Polytec catalog”)**

On Page 21, Item 24 of the Office Action, Claims 82-84 were rejected under 35 U.S.C. §103(a) based on the Webster and Savage patents, in further view of the
10 Polytec Product Catalog July 1996 Pages 1-15 (“the Polytec catalog”).

The Polytec catalog discloses various models of laser vibrometers. However, it does not appear that it discloses any optical filters. The laser vibrometers disclosed in the Polytec catalog are directed to non-contact sensing applications. In contrast, the Savage patent discloses contact vibration and sensing methods. Accordingly, the
15 Polytec catalog “teaches away” from the Savage patent. Therefore, the combination of the Webster and Savage patents in view of the Polytec catalog is respectfully traversed because it would not have been obvious for a person of ordinary skill in the art to combine these disclosures as done in the Office Action. Withdrawal of the rejection is requested.

20 In addition, Claims 82-84 have been amended to depend from Claim 64. The Polytec catalog fails to disclose the deficiencies of the Webster and Savage patents as previously noted with respect to Claim 64. Accordingly, Claims 82-84 would not have been obvious to a person of ordinary skill in the art for this reason.

In addition, Claims 64 that has been amended to include the limitations of
25 Claim 73 noted as allowed in the Office Action. Accordingly, Claims 82-84 are patentable by dependency from an allowed Claim.

Furthermore, the Polytec catalog fails to disclose an optical filter as claimed in Claim 83. Accordingly, Claim 83 would not have been obvious to a person of ordinary skill in the art for this additional reason.

30 Thus, the combination of the Webster and Savage patents in view of the Polytec Product Catalog is respectfully traversed. Also, it is submitted that Claims

82-84 would not have been obvious to a person of ordinary skill, and thus are patentable over the prior art. Withdrawal of the rejection is requested.

Any and all statements of the Office Action not expressly admitted in this Amendment are hereby traversed.

5

Summary


It is submitted that approval of drawing changes is requested to overcome the informalities in the drawings. It is further submitted that Claims 6, 7, 14, 25, 27, 29, 31, 57, 59, 61, and 63 have been amended as necessary to overcome the objection. In addition, it is submitted that Claims 1-10, 13-15, 24-65, and 67-72, and 74-93
10 patentably distinguish over the prior art. Lastly, it is submitted that outstanding issues with respect to Claims 11, 12, 16-23, 66, and 73 are moot since such Claims have been canceled without prejudice. Reconsideration of those Claims not previously allowed and an early Notice of Allowance are earnestly solicited for all pending claims.

15 If the Examiner has any question regarding this Amendment, kindly contact the undersigned at the telephone number indicated below.

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Mark Up Version of Specification and Claim Amendments

Page 1, Paragraph 4, please delete paragraph in its entirety.

Page 2, Paragraph 1, delete in its entirety and replace with the following:

A first disclosed method comprises optically sensing vibration from a
5 structure, and determining whether a fault exists in the structure, based on the
optically-sensed vibration. The fault can be damage or deterioration to a structure
element, or a dislocation of structure elements normally joined, or improper joining of
structure elements, for example. Such structure elements can be a foundation, roof,
ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame,
10 window, window frame, duct, plumbing, piping, or hanger, for example. The optical
sensing can be performed by an optical vibration sensor (OVS) that can be a laser
vibrometer, for example. The determination of whether a fault exists in the structure
can be performed by a computer and/or a human operator.

Page 10, Paragraph 3, please delete and replace with the following:

15 "Structure element" can be a foundation, roof, ceiling, floor, wall, beam, column,
support, joist, [wall,] wall panel such as dry wall, wall frame, window, window frame,
duct, plumbing, piping, hangers, or other element used in the construction or
renovation of a building, house, or other structure.

In the Claims

Please CANCEL Claims 11, 12, 16-23, 66, 73 without prejudice.

Please AMEND Claims 1-4, 14, 25, 27, 29, 31, 57, 59, 61, and 63 as follows:

1. (Once Amended) A method comprising the steps of:

5 a) vibrating ground in proximity to a structure resting on the ground to produce vibration in the structure, the structure being a house or building;

 [a]) b) optically sensing vibration from [a] the structure without contacting the structure; and

 [b]) c) determining whether a fault exists in the structure, based on the
10 optically-sensed vibration[optically-sensed in the step (a)].

2. (Once Amended) A method as claimed in claim 1 wherein the step [(a)] (b) comprises substeps of:

 [a1]) b1) generating and transmitting a laser beam to the structure;

 [a2]) b2) receiving the laser beam from the structure;

15 [a3]) b3) detecting Doppler shift in the received laser beam relative to the transmitted laser beam; and

 [a4]) b4) determining at least one of the peak displacement and velocity of the vibration, based on the detecting of the substep [(a3)] (b3).

3. (Once Amended) A method as claimed in claim 1 wherein the sensing of the
20 step [(a)] (b) is performed by sensing peak displacement of the vibration from at least one portion of the structure.

4. (Once Amended) A method as claimed in claim 1 wherein the sensing of the step [(a)] (b) is performed by sensing peak velocity of the vibration from at least one portion of the structure.

25 5. (Once Amended) A method as claimed in claim 1 wherein the sensing of the step [(a)] (b) comprises optically sensing vibrations from different portions of the structure corresponding to similar elements of the structure, the method further comprising:

 [c]) d) comparing the vibrations from the different portions of the
30 structure; and

the determining of step [(b)] (c) performed based on the result of the comparing of the step [(c)] (d).

6. (Once Amended) A method as claimed in claim 5 wherein the comparing of the [substep (b1)] step (d) is performed based on peak displacement of the vibrations.

5 7. (Once Amended) A method as claimed in claim 5 wherein the comparing of the [substep (b1)] step (d) is performed based on peak velocity of the vibrations.

8. (Once Amended) A method as claimed in claim 1 wherein the step [(a)] (b) is performed with a laser vibrometer.

9. (Once Amended) A method as claimed in claim 1 wherein the step [(a)] (b)
10 is performed with a Doppler laser vibrometer.

10. (Once Amended) A method as claimed in claim 1 wherein step [(b)] (c) is performed with a computer.

13. (Once Amended) A method as claimed in claim [11] 1 wherein the step (c) comprises driving a vehicle over spaced objects to vibrate the structure.

15 14. (Once Amended) A method as claimed in claim [11] 1 wherein the step (c) comprises vibrating the ground with [an] a ground vibrator.

15. (Once Amended) A method as claimed in claim [11] 1 wherein the step (c) comprises vibrating the ground by generating an explosion.

24. (Once Amended) A method as claimed in claim 1 wherein the performance
20 of the step [(b)] (c) determines that the fault exists in the structure, the fault being damage of a structure element.

25. (Once Amended) A method as claimed in claim 24 wherein the structure element comprises at least one of a foundation, roof, ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct,
25 plumbing, piping, or hanger.

26. (Once Amended) A method as claimed in claim 1 wherein the performance of the step [(b)] (c) determines that the fault exists in the structure, the fault being deterioration of a structure element.

27. (Once Amended) A method as claimed in claim 26 wherein the structure
30 element comprises at least one of a foundation, roof, ceiling, floor, wall, beam,

column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct, plumbing, piping, or hanger.

28. (Once Amended) A method as claimed in claim 1 wherein the performance of the step [(b)] (c) determines that the fault exists in the structure, the fault being a dislocation or separation between structure elements normally joined.

29. (Once Amended) A method as claimed in claim 28 wherein the structure elements each comprise at least one of a foundation, roof, ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct, plumbing, piping, or hanger.

31. (Once Amended) A method as claimed in claim 30 wherein the structure elements each comprise at least one of a foundation, roof, ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct, plumbing, piping, or hanger.

54. (Once Amended) A method as claimed in claim [1] 32 wherein the structure is a building.

55. (Once Amended) A method as claimed in claim [1] 32 wherein the structure is a house.

56. (Once Amended) A method as claimed in claim [1] 32 wherein the performance of the step (b) determines that the fault exists in the structure, the fault being damage of a structure element.

57. (Once Amended) A method as claimed in claim 56 wherein the structure element comprises at least one of a foundation, roof, ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct, plumbing, piping, or hanger.

58. (Once Amended) A method as claimed in claim [1] 32 wherein the performance of the step (b) determines that the fault exists in the structure, and the fault is deterioration of a structure element.

59. (Once Amended) A method as claimed in claim [56] 58 wherein the structure element comprises at least one of a foundation, roof, ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct, plumbing, piping, or hanger.

60. (Once Amended) A method as claimed in claim [1] 32 wherein the performance of the step (c) determines that the fault exists in the structure, and the fault is a dislocation or separation between structure elements normally joined.

61. (Once Amended) A method as claimed in claim 60 wherein the structure
5 elements each comprise at least one of a foundation, roof, ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct, plumbing, piping, or hanger.

62. (Once Amended) A method as claimed in claim [1] 32 wherein the performance of the step (c) determines that the fault exists in the structure, and the
10 fault is an improper joining of structure elements.

63. (Once Amended) A method as claimed in claim 62 wherein the structure elements each comprise at least one of a foundation, roof, ceiling, floor, wall, beam, column, support, joist, [wall,] wall panel, wall frame, window, window frame, duct, plumbing, piping, or hanger.

64. (Once Amended) A system for detecting a fault in a structure, the system for use with a remote computer and a network, the system comprising:

an optical vibration sensor (OVS) positioned in proximity to the structure, the OVS optically sensing vibration of the structure, the OVS generating an OVS signal based on the sensed vibration from the structure, the OVS signal
20 indicating whether the fault exists in the structure; and

a computer coupled to receive the OVS signal, the computer determining whether a fault exists in the structure based on the OVS signal, the computer generating a computer signal indicating whether the fault exists in the structure,

25 the computer coupled to supply the computer signal indicating whether a fault exists in the structure to the remote computer via the network.

65. (Once amended) A system as claimed in claim 64 [further comprising:

a] wherein the computer is coupled to receive the OVS signal, the computer generating a display based on the OVS signal, the display used by a human
30 user to determine whether a fault exists in the structure.

75. (Once Amended) A system as claimed in claim [65] 64 further comprising:

an OVS controller (OVSC) coupled to receive the signal from the OVS, the OVSC generating a signal indicating vibration velocity of at least one portion of the structure, the OVSC coupled to supply the signal indicating the vibration velocity to the computer as the OVS signal.

- 5 76. (Once Amended) A system as claimed in claim [65] 75 wherein the OVSC is coupled to the OVS, and is operable to automatically focus the OVS on the structure.